ANNUAL REPORT

OF

THE HOWE LABORATORY OF OPHTHALMOLOGY

HARVARD MEDICAL SCHOOL

AT THE

MASSACHUSETTS EYE AND EAR INFIRMARY

1969

243 CHARLES STREET

BOSTON, MASSACHUSETTS 02114

STAFF

David G. Cogan, M.D.: *Henry Willard Williams Professor of Ophthalmology—Director*
W. Morton Grant, M.D.: *Professor of Ophthalmology*
Jin H. Kinoshita, Ph.D.: *Associate Professor of Biochemical Ophthalmology*
Toichiro Kuwabara, M.D.: *Associate Professor of Pathology*
David D. Donaldson, M.D.: *Associate Clinical Professor of Ophthalmology*
Robert D. Reinecke, M.D.: *Assistant Professor of Ophthalmology*
Shirley H. Wray, M.D.: *Assistant Professor of Ophthalmology*
Gerald J. Chader, Ph.D.: *Instructor in Ophthalmic Research*
Stephen J. Fricker, M.D.: *Instructor in Ophthalmology*
Judith A. Jedziniak, Ph.D.: *Instructor in Ophthalmology*
Liane Reif-Lehrer, Ph.D.: *Instructor in Ophthalmic Research*
David M. Worthen, M.D.: *Instructor in Ophthalmology*
Lorenzo O. Merola, M.S.: *Associate in Ophthalmic Research*
Charles Snyder: *Librarian*
Roger C. Lancaster: *Medical Photographer*

TEMPORARILY ATTACHED TO THE LABORATORY

Special Fellows and Assistants

Douglas R. Anderson, M.D.: *USPHS (Center Grant)*
Bruce A. Ellingsen, M.D.: *USPHS (Center Grant)*
Janet Thorndike, Ph.D.: *USPHS (Postdoctoral Research Fellowship)*
Isla M. Williams, M.D.: *USPHS (Center Grant)*
Neil R. Willis, M.D.: *Ontario Department of Health Fellowship*
Jerry B. Wurster, M.D.: *USPHS (Center Grant)*

Pre-resident and Pre-doctoral Trainees

David L. Epstein, M.D.
Kurt A. Simons

HOWE LABORATORY OF OPHTHALMOLOGY
HARVARD UNIVERSITY MEDICAL SCHOOL
MASSACHUSETTS EYE AND EAR INFIRMARY

243 CHARLES STREET
BOSTON, MASSACHUSETTS 02114

March 1970

To friends of the Howe Laboratory:

This Annual Report comes across your desk - or by your armchair as the case may be - with a miscellany of other mail. We have no illusions about its priority and can only hope that a few may find it of more than passing interest. It does represent the labors of many investigators wholly dedicated to ophthalmic research and it reflects, however inadequately, the tremendous cooperation and benefaction of those many persons and foundations that have supported our endeavors.

Faithfully yours,

David G. Cogan

David G. Cogan, M.D.

DGC:ms

This Report is prepared annually for our many benefactors and friends who have concern for the eye and its diseases and who have demonstrated their concern by generously supporting the researches in the Howe Laboratory. It is a report to investors in a scientific and humanitarian effort of incalculable dimensions and, we hope, an assurance that the investments have been wisely and productively placed.

We make no apologies for the technicality of the Report. Much of it may be incomprehensible to many readers but, faced with the alternatives of an accurate though technical record versus a popular but less accurate account, we choose the former.

GLAUCOMA

In his dual role as senior investigator in the Howe Laboratory and Director of the Infirmary's Glaucoma Consultation Service, Dr. Grant has supervised a wide program involving not only the Laboratory but also the Out-Patient Clinic, operating rooms, Eye Bank, Pathology Laboratory, and Children's Medical Center—fulfilling our long-standing practice of applying basic research to the benefit of the patient.

Tonometer studies

Because measurement of intraocular pressure is crucial to the diagnosis and treatment of glaucoma, a continuous effort is being made to improve the accuracy and to control the variable of tonometry and tonography. A computer-assisted comparison of Goldman applanation and Schiotz tonometers by Drs. Grant and Anderson has pointed up the need and provided a basis for new calibration tables. Comparison of other tonometers will shortly be reported by Drs. Guzak and Swarr.

Drug effects and provocative glaucoma testing

The literature frequently reports benefit from drugs which on further evaluation prove ineffective or impracticable. Reports of provocative tests for glaucoma also often fall short of the enthusiasm of their proponents. The testing of these claims is time-consuming but necessary and a distinct service to the medical community. This past year the alleged benefits from oral administration

of asorbic acid has been found by Drs. Peczon and Nicholson to be offset by excessive gastro-intestinal side-effects. Moreover, the claimed benefits of clofibrate and propanolol were not confirmed.

The potential hazards of atropine-like drugs used in the treatment of Parkinson's disease and many other illnesses is a question frequently raised in connection with patients having glaucoma. Drs. Lazenby, Reed, and Grant found no adverse effect on the ocular tension resulting from standard doses of atropine given by mouth for a single day but they did find a cumulatively adverse effect on the intraocular pressure in a small proportion of patients with open-angle glaucoma when the drugs were given daily for a week. They have proposed a simple test which appears to identify those patients who should be particularly cautious in using these drugs.

Surgery in glaucoma

Urgently needed is an antiglaucoma operation for those desperate cases in which the anterior segment is extremely abnormal and the glaucoma threatens to extinguish vision. Hope for such a procedure was raised by Drs. Chandler and Grant's observation of success in rare instances by the fortuitous development of a filtration bleb at the site of penetrating cyclodiathermy. But in a critical analysis Dr. David Walton found that relief of glaucoma was attained in only 5% of such cases of penetrating cyclodiathermy and that the procedure entailed an equal risk of inducing hypotony.

Freezing filtration blebs to increase drainage appeared successful initially but this has not been borne out in a subsequent series studied by Dr. Peczon. The effects of freezing of a substantial portion of the ciliary body (a procedure known as cryocyclotherapy) in selected cases is currently being studied by Drs. Gaudio and Michon.

Laboratory studies

That the trabecular meshwork in the angle of the anterior chamber is the site of normal obstruction to aqueous outflow was previously demonstrated by Dr. Grant. It has now been confirmed by Dr. Ellingsen who, with improved techniques, is making a detailed and revealing study of the physical relationship between the corneo-scleral meshwork, Schlemm's canal, and collector channels in the sclera, with especial reference to the mechanism of action

of various medical and surgical modes of treatment. The angle meshwork of the monkey eye which provides the standard experimental model for these hydrodynamic studies has been shown to similarly limit the outflow but, for some as yet mysterious reason, it responds to elevated pressure in ways different from the human eye.

The new scanning electron microscope, has added substantially to the glaucoma studies. Dr. Worthen has convincingly demonstrated pores in the meshwork and Dr. Anderson has presented suggestive evidence that zonular fragments released by alpha chymotrypsin during routine cataract extraction can plug the out-flow channels.

HISTOPATHOLOGY

Scanning Electron Microscopy

Unlike conventional electron microscopes which employ transmitted cathode beams and reveal internal ultrastructure, scanning electron microscopes employ secondary electrons and reveal surface contours that have permitted anatomic displays at many thousand magnifications.

With the generous support from the Massachusetts Lions Clubs in the purchase of equipment and from the National Institutes of Health for operating expenses, Dr. Kuwabara was able to establish the first biomedical institution for scanning electron microscopy. The accompanying photograph gives an example of the possibilities of scanning electron microscopy from Dr. Kuwabara's collection. These photographs are even more spectacular when prepared for three dimensional viewing which is easily accomplished with the scanning microscope.

Light and retinal degeneration

A dominant interest in histology, and especially in its ultrastructure as revealed through electron microscopy, continues to be the effect of light on the photoreceptors of the retina. Dr. Kuwabara's observation that continuous exposure to light causes a characteristic change in the outer segments of the rods and cones raises the very practical problem of differentiating physiologic and pathologic changes. The one is reversible and the other is not, but histopatho-

logic changes merge into each other without any clear demarcation. Both are initially characterized by vacuolization and disintegration of the tip-most plates in the outer segments with corresponding changes in the adjacent pigment epithelial cells. With prolonged or intense exposure, the outer segments, the cell bodies, and the pigment epithelium disappear in that order.

View of the "business" end of the retinal rods as seen with the scanning electron microscope at a magnification of 3,000 times. Each individual rod has a diameter of 1/10,000 inch and contains packets of photosensitive substance. The human retina contains approximately 180 million such rods which during life are arranged with an orderliness that is only partially preserved in the present illustration. This electron micrograph, prepared by Dr. Kuwabara, is believed to be the first such picture taken by the technique which permits photography of the intact (unsectioned) retinal photoreceptors.

The relevance of these observations to human pathology is our prime concern. Dr. Kuwabara and Mr. Richardson's most recent finding that senile but otherwise normal eyes have similar changes in their macular photoreceptors raises again the relationship of light exposure to the enigmatic occurrence of macular degeneration. The quality of light and type of damage is also under study. Preliminary observations have shown that the hot or incandescent type of light produces disproportionate damage to the pigment epithelium in

comparison with the cool fluorescent light, but much more information is needed.

Miscellaneous histopathologic studies

Opportunities frequently arise to make special study of selected abnormalities. Some of these involve application of electron microscopy for the first time to tissue of specific diseases. Thus Drs. Reinecke and Kuwabara were able to present ultrastructural evidence that in temporal arteritis it is the muscle which is primarily affected with secondary changes in the elastica. And Drs. Simmons and Kuwabara were able to show by scanning electron microscopy that the abnormally growing epithelium in the anterior chamber had the same contour characteristics as it does normally on the surface of the eye. The opportunity to study two early cases of traumatic pseudo retinitis pigmentosa suggested to Dr. Cogan that the primary abnormality was lysis of the photoreceptors by released lysosomes rather than, as generally believed, primary loss of the photoreceptors. This would account for the highly selective loss of the rods and cones in certain cases of injury.

In several studies of the out-flow channels by scanning electron microscopy Dr. Anderson compared the trabecular meshwork of eight species of monkeys, evaluated the changes in enzyme glaucoma, prepared material from cases of congenital glaucoma and, as previously noted, described the changes in monkey eyes following zonulysis by alpha chymotrypsin.

Electron microscopy of experimental galactose cataracts by Dr. Kuwabara suggested that the lens cells lost water to the interfiber space prior to the development of a frank cataract.

BIOCHEMISTRY

Sugar Cataracts

Dr. Kinoshita and his co-workers have concentrated on sugar cataracts — especially those resulting from excess glucose, galactose or xylose — because these are most easily produced in animals and in the test tube through appropriate changes in the diet or metabolic environment. It is nevertheless certain that many of the fundamental observations will have relevance to the pathogenesis of cataracts in general.

The primary biochemical event in sugar cataracts is the conversion of the sugar (an aldehyde) to sugar alcohol by aldose reductase. Inhibition of this enzyme in the test tube was found to be successful in preventing cataracts and we noted in last year's Report that this was the first substantial lead for a medical means of preventing cataracts. Enzyme inhibition was subsequently shown to be effective when injected into the eye. An all out effort has been made this past year, in conjunction with Ayerst Laboratories, to develop an inhibitor which will be suitable for oral administration and which will get into the eye in effective concentration. This has not yet been achieved but looks promising.

Xylose cataracts have presented a special problem from the experimental point of view. Although vacuoles occurred as with other types of sugar cataracts, the dense nuclear opacities seen after alloxan injection and galactose feeding, were reported to be lacking. We have now found the reason lay in the inadequate blood levels of xylose. When xylose concentration was adequate, similar cataracts occurred. The xylose cataracts in the test tube can be inhibited by aldose reductase inhibitors, supporting the concept of a similar origin of all sugar cataracts.

To acquire information on the key aldose reductase, Dr. Jedziniak has been able to isolate this enzyme electrophoretically in relatively pure form from calf lens. It has been found extremely labile and requires a sulfhydryl compound to maintain its activity. Exposure to inhibitors causes it to revert to an inactive form, even in the presence of sulfhydryl compounds and it then has a markedly different electrophoretic pattern. It is now possible to study in detail the action of the inhibitors on aldose reductase.

Cataracts and Red Blood Cells

The cells that constitute the lens fibers and those that form the blood corpuscles have surprisingly much in common. Both survive without nuclei and both have unusually high quantities of glutathione (GSH). In the red cells overwhelming evidence indicates that GSH is essential for viability. The red cells hemolyze when the GSH level is reduced. In the case of the lens, cataracts are associated with lowering of glutathione and the question is whether similar processes are responsible for cataracts and hemolysis.

Accordingly, Dr. Epstein in collaboration with Dr. Kinoshita,

has subjected the lens to experimental variations analogous to those which have been employed for the red blood cells. Specifically, various GSH oxidants are being used to determine what metabolic processes are affected. Of the notable observations to date, it appears that GSH is less susceptible to the oxidants than are the sulfhydryl groups in the membranes but that glucose in some way exerts a protective effect.

Development of the retina

To uncover the factors which control development in such a complex tissue as the retina, it is essential to use a simple tissue preparation and to have a biochemical marker that is consistently reproducible. Dr. Reif-Lehrer has, as noted in last year's Report, chosen the retina from the developing chick eye as the tissue and the enzyme glutamine synthetase as the prime marker. Dr. Chader has now joined the study and will, among other things, make a comparable study of the developing rat retina.

While glutamine synthetase develops normally at a particular stage of "embryonic" development, it may be induced prematurely by cortisol and other steroids. Present studies aim to determine the functional groups on the steroid which bind to a retinal receptor and those which effect the synthesis of the enzyme. Also being studied is the binding of the corticoid to a serum globulin which has been found to play a role in the enzyme induction. Along with glutamine synthetase the appearance of other macromolecules (enzymes, glycogen, etc.) are being studied with a view toward uncovering the controlling events in normal and diseased retinas. The eventual aim is to learn how to manipulate these events so as to control abnormal states.

NEURO-OPHTHALMOLOGY

General activities

Neuro-ophthalmology is possibly the most academic of ophthalmology's clinical sub-specialties. This is one reason for housing it in the Howe Laboratory. (Another is the very practical one that no space elsewhere has been provided.) Its research aspects have stemmed largely from patients' problems and from the stimulating

contacts with the neurologic services at the Massachusetts General Hospital and other hospitals in Boston. Dr. Shirley Wray, a neurologist of prestigious English training, has added immeasurably to our functions. Her Wednesday afternoon conferences conducted this past year with the assistance of Drs. Wurster, Williams, Willis and Residents have consistently attracted an impressive attendance from various hospital departments and medical schools.

Specific studies of the past year having a strictly clinical orientation were: an analysis of the records on approximately 200 patients with internuclear ophthalmoplegia with emphasis on some of the less well recognized aspects (Dr. Cogan); an evaluation of tensilon tonography in the diagnosis of myasthenia gravis (Drs. Wray and Langston); an analysis of down-beat nystagmus from a topologic and diagnostic point of view (Dr. Cogan); a study of intermittent dilatation of one pupil (Mr. Hallett and Dr. Cogan); a review of the fluoroangiographic and pathologic basis for macular edema (Drs. Cogan and Guzak); the significance of acquired paralysis of upward gaze (Dr. Willis); the occurrence of ocular motor nerve involvement with pituitary apoplexy (Dr. Willis); a search for abnormality of serum elastase in patients with angioid streaks (Drs. Williams and Bardawil); a continuing study of ACTH in retrobulbar neuritis (Drs. Poskanzer, Collis and Cohen); and an evaluation of steroid treatment on the histopathology of temporal arteritis (Dr. Cohen).

Those studies having an experimental orientation included: fluoroangiographic techniques in primates (Dr. Wray and Mr. Lancaster); a comparison of the retinal blood vessels in eight species of monkeys by means of fluoroangiography and silicon rubber injection (Dr. Anderson); tissue culture of nerve and muscle tissue from animals and of lymphocytes from patients with neurologic disease (Dr. Wray); the role of pleuro-pneumonia-like organisms in ataxic disease of rats (Drs. Wray and Langston); and an attempt to produce papilledema in the owl monkey by elevating the intracranial pressure and lowering the intraocular pressure (Drs. Anderson and Wray).

Congenital abnormalities of the retina

Believing that the pathogenesis of congenital retinal abnormalities was inadequately understood, Dr. Cogan welcomed the invi-

tation to participate in the Symposium on Birth Defects and to attempt a meaningful classification of those cases obtained from his files and from the files of the Infirmary's collection. The approximately 50 histopathologic cases and many more clinical cases grouped themselves into: (1) those associated with colobomas, pits, staphylomas, and orbital cysts—all associated with failure in closure of the embryonic cleft; (2) those characterized by retinal folds, central stalks, and detachments, including the 13–15 trisomy cases; (3) retrolental fibroplasia; (4) persistent hyaloid remnants; (5) massive gliosis of the retina; (6) congenital absence of ganglion cells; and (7) congenital absence of photoreceptors.

Clinical electrophysiology

Whereas electric recording of retinal signals (electroretinography) or of occipital-evoked potentials customarily involves interpretation of wave form and amplitudes, Dr. Fricker's technique involves chiefly measurement of time-delay between the stimulus and the response. The stimulus consists of stroboscopic light flashes of varying frequency while the time delays are indicated by phase differences in the signal. This method provides a more reliable and measurable index of function than conventional methods and, when sufficient data is collated, should have considerable clinical usefulness in assessing the presence, site, and degree of normality in the visual system.

Instrumentation for assessment of ocular motor function is also being developed by Dr. Fricker using a photo-electric indicator of changes in eye position, velocity and acceleration as the parameters to be measured. As with the testing of visual functions, the new instruments are being continuously applied to various clinical conditions in which they will ultimately be found most useful.

New tests for fusion and stereopsis have been devised by Dr. Reinecke and are currently being subjected to clinical trial. A series of random dots generated by computers to form meaningless patterns when viewed monocularly reveal specific symbols when viewed binocularly. The E pattern used conventionally for assessing acuity of children has been duplicated with the dot pattern or vectograph that can be viewed through polaroid glasses. This provides a feasible and semiquantitative index of stereopsis in children who, although illiterate, will respond to the "E" game. A further

adaptation of the random dot method has been devised for those unable to cooperate subjectively, by creating on an optokinetic drum a series of vertical lines that can be seen only in the presence of binocular and stereoscopic vision. A positive response in such cases is indicated objectively by the presence of an optokinetic response.

Neuro-ophthalmic demonstrations and conferences

Consistently informative and often enjoyable are our participation in various neuro-ophthalmic conferences. Dr. Guzak and Mr. Lancaster supervised an exhibit on fluoroangiography at the annual meeting of the American Medical Association. Dr. Cogan was one of the participants in the Lake Mohonk (N.Y.) Conference, "The Influence of Early Experience on Visual Information Processing" where he presented congenital apraxia as the only form of dyslexia due to ocular motor abnormalities. He also participated in a three-day symposium of physicians, physicists, and engineers on visual prostheses for the blind.

TOXICOLOGY

When Dr. Grant published his text "Toxicology of the Eye" several years ago he became unwittingly a source of reference for innumerable private, industrial and government consultations. His files have grown apace and the total number of alleged toxicological hazards now listed with him greatly exceeds the total number listed in his text. Similarly his participation in relevant affairs has multiplied as is evident by his services on several national committees dealing with drugs and toxic agents.

At the local level one small epidemic of keratoconjunctivitis was shown by Dr. Dahl to be associated with the use of a commercial skin cream. In experiments with Dr. Grant the toxic component was found to be a greaseless gel which caused loss of corneal epithelium and clouding of the corneal stroma.

OPTICS AND INSTRUMENTATION

The Howe Laboratory became involved in the instrumentation of ophthalmoscopy some twenty years ago when Dr. Schepens de-

veloped his now famous indirect ophthalmoscope while a member of the Laboratory. Dr. Donaldson has now perfected a direct binocular ophthalmoscope which has the advantages of preserving the image orientation of direct ophthalmoscopy and freedom from light reflexes. It has, however, the unavoidable disadvantages of reduced resolution and poor visualization of the retinal periphery. Its place in our present armamentarium is being presently evaluated.

While spending a three-month elective period with us, medical student Mr. Guyton developed a continuously variable optometer capable of refracting the eye in less than 60 seconds when applied by a technician to an average patient. The instrument has a linear calibration and is optically accurate to a tenth of a diopter over a 44 diopter range. Present modifications are directed toward overcoming an "instrument myopia" induced by the patient's sense of nearness during the testing.

VISION INFORMATION CENTER

In the Vision Information Center our aim and that of its sponsor, the National Institutes of Health, has been to develop a computerized system of literature retrieval which will be available to those needing rapid access to information on vision. It has been a joint development of the Howe Laboratory and Countway Library (Harvard Medical School) and has for most of its existence been directed by Dr. Reinecke.

The ground work involved developing a thesaurus which covered the field of vision and preparing a comprehensive computer program for this and for teaching programs. During 1969 the computerized model began operation with a moderate number of users scattered throughout the United States. A small console about the size of a large typewriter permits a connection by way of telephone lines with the Harvard Computer Center. It is essentially portable and has been hooked up for demonstration purposes at several national meetings. The French Chibret Institute has prepared a French translation of the Center's thesaurus using the same code numbers and thereby ensuring uniformity in terms and eponyms for the French and English literature on vision.

With Dr. Reinecke's departure for Albany, it has seemed appropriate that most of the activities of the Vision Information Cen-

ter should also be transferred to this new site. We feel confident that it will continue to pioneer this very important aspect of service and are happy that we had the opportunity to participate in its inauguration.

TEACHING

The current reorganization of curricula in medical schools provides greater freedom of elective courses for the students and affords the opportunity of earlier specialization for those students wishing it. The Howe Laboratory, long associated with education at the post graduate level, experimented this past year with the introduction of an undergraduate course for prospective ophthalmologists. Given for two months to twelve students, it emphasized clinico-pathologic correlations and attempted to bridge the transition from general studies to special ophthalmic applications.

Our severely restricted space prevents us from accommodating more than an occasional student in advanced training. It was possible, however, to have one student this past year spend three months with us ("the happiest and most profitable of my entire medical school experience") studying optics and eventually winning honors for work begun in the Laboratory, another who pursued neuro-ophthalmology, and another, a Ph.D. candidate from the Cambridge campus, who is preparing his thesis on the psychologic moments of visual sampling. We wish that space permitted expansion of this important and mutually profitable aspect of the Laboratory's functions.

Continuing a program begun two years ago sponsored by the Howe Laboratory, an additional day was added to the annual alumni meeting reviewing some of the research activities at the Infirmary. This has been a welcome occasion for a general discussion of activities with those who otherwise have little contact with the Laboratory.

Perhaps the most influential role in education is the give and take of members of the Howe Laboratory in the innumerable conferences that occur with individuals, groups, and meetings at widely differing levels of formality and frequency. Dr. Reinecke has conducted daily ocular motility rounds and Dr. Grant "commutes" continually between his Laboratory and the Glaucoma Clinic. Dr.

Cogan participated particularly in the weekly pathology sessions and with Dr. Wray in the neuro-ophthalmic rounds. Our doors are always open to those with serious intent, for such contacts are mutually profitable.

AWARDS, APPOINTMENTS AND INVITATIONAL LECTURES

The Trustees Award of Research to Prevent Blindness, Inc. was made this past year conjointly to Drs. Cogan, Grant, Kinoshita and Kuwabara. In a real sense this was recognition of a laboratory accomplishment rather than that of an individual, a precedent which we find most unusual and appropriate.

We feel a measure of reflected glory in the appointment of Carl Kupfer, formerly of the Howe Laboratory, as the first Director of the new Eye Institute at the National Institutes of Health. While with us from 1958 to 1966, Dr. Kupfer was a productive investigator and director of our training program. He now occupies one of the most influential and challenging positions in American ophthalmology. In announcing his appointment, Dr. Marston, Director of the National Institutes of Health said "Dr. Kupfer's special scientific and administrative qualifications and his broad background in several different areas of ophthalmic research will be important in establishing the programs and directing the growth of the new Institute."

Dr. Cogan was, this past year, Chairman of the Association of University Professors in Ophthalmology and President of the Massachusetts Eye and Ear Infirmary Alumni Association. He was also appointed to the first Council of the National Eye Institute, was Visiting Professor at Washington University (St. Louis) and at Johns Hopkins, and was made an honorary member of the Alumni Association of the Armed Forces Institute of Pathology and of the American Neurologic Association. He gave the American Ophthamological Society's Verhoeff Lecture which this year was assigned to a vignette on the life and times of Dr. Verhoeff.

Dr. Reinecke was Visiting Professor of Ophthalmology at Johns Hopkins (Wilmer Institute) and at the University of California (Los Angeles). Dr. Grant's several appointments included continued membership on committees on drugs of the American

Academy of Ophthalmology and Otolaryngology, the National Research Council, and the National Institutes of Health and on committees for glaucoma study and tonometer testing of the American Academy and the Massachusetts Department of Health. Dr. Kuwabara was Visiting Professor at the University of California (Los Angeles) and at Queen's University (Kingston, Ontario) and has been appointed Director of the Biological Section of the New England Electron Microscopy Society.

Dr. Kinoshita's term on the Sensory Disease Study Section of NIH was completed this past year and he was appointed Chairman of the Board of Trustees of the Association for Research in Ophthalmology. This latter has especial significance since very few non-ophthalmologists have been so honored.

ORGANIZATION

Personnel

With the end of this year the Howe Laboratory and the local medical affiliates lose two persons who have contributed greatly to the investigative and administrative functions of the Laboratory and Infirmary in recent times. They are Drs. Robert D. Reinecke and David M. Worthen. Dr. Reinecke leaves to become Chairman of the Department of Ophthalmology at Albany and Dr. Worthen leaves to join a former Howe Laboratory member, Dr. Herbert Kaufman, at the University of Florida. It seems appropriate that we cite some of their activities in this record by way of acknowledging our appreciation of them and establishing their contribution in our local history.

Dr. Reinecke first joined the Laboratory part-time as a summer Fellow in 1957 while still a medical student. Later full-time Fellow, Instructor, and more recently Assistant Professor, Dr. Reinecke has, along with his investigations and part time practice, been the key person in administration of the Center Grant for Clinical Research, organization of the Vision Information Service, director of the Ocular Motility Clinic, and supervisor of the Ophthalmic Assistants Program. It was he, more than anyone else, who was responsible for the successful operation of the Howe Consultation Service, the inauguration of ophthalmology at the Bunker Hill Center, the restructuring of the out-patient clinics at the Infirmary,

the introduction of routine cardiac monitoring into the Infirmary's operating suites, and the application of computer technology to teaching and research in the Department of Ophthalmology. Dr. Reinecke's many contributions will be sorely missed.

Dr. Worthen became attached to the Laboratory prior to his residency in 1965. Under Dr. Kuwabara's supervision he developed an unusual competence in electron microscopy of the eye which he continued to pursue during and subsequent to his residency. During this period he developed, with Dr. Brubaker, a technique for cryoextraction of the lens in cataract surgery, became one of our most popular teachers at widely differing levels of pedagogy, and undertook a commendable evaluation of the socioeconomic aspects of local medical care. Dr. Worthen had the rare combination of wide interests and great industry.

Goals

In the more than thirty-five years of its existence, the Howe Laboratory has constantly tried to bring the basic and clinical sciences into a collaborative effort. This has been a pleasant and productive enterprise but always requiring mutual understanding, patience, and support. We have had a generous measure of all three and we look forward to continued development of an environment where clinicians and laboratory scientists can work and study together in harmony and mutual edification.

We do not feel, however, that we have grown in recent years in proportion to the local potential or in proportion to that of other ophthalmic centers. The reasons are to us obvious. The strain imposed by the severe space restrictions, lack of sympathy for the development of a full-time staff, fractionation of resources by competitive interests, squandering of time on irrelevant issues—all have hampered the natural growth of the Howe Laboratory. Yet we are optimistic for the future. Tradition can be a liability but it can also be an asset. With a sound record and a core of dedicated investigators, we feel that the time is approaching when a major step can be taken, when with adequate support we will find a place to accommodate the ebullient researches, to facilitate the training of ophthalmologists and ophthalmic investigators, and to continue leadership in this most important field of medicine.

As a possible beacon in this direction is the establishment this

year of an endowed professorship which will be available to the Howe Laboratory. This endowment provided by the generosity of the Scaife family and matched by the Permanent Charity Fund resulted from the initiation of Dr. John Carroll. To all we are tremendously indebted and feel certain that those who were responsible for it can eventually look back with pride for their decision in 1969.

Those who originally conceived the present Laboratory planned for (and were promised) a separate building. For many reasons this has never come about. It would now seem appropriate to re-evaluate the original intent and to solicit support for such a concept where the diverse and widely scattered researchers on the eye and its diseases could be centered. Where could a few million dollars be more profitably spent? With this open-ended question and ill-concealed suggestion we submit the Report for 1969.

ACKNOWLEDGEMENTS

In listing this year's benefactors to the Howe Laboratory we feel most grateful for the generous support which we have had from individuals, firms, charitable organizations, and government and for the faith which these benefactors have entrusted in us. The Howe Laboratory endowment provides only about one-fifth of the Laboratory's operating expenses. A sizeable portion of the budget has come from the National Institutes of Health and this source is now being cut back. The Massachusetts Lions Clubs have been a major bulwark during this retrenchment and we have received important aid from the American Contract Bridge League and Research to Prevent Blindness, Inc. But no less important have been the many individuals and organizations that have included the Howe Laboratory in their philanthropies. One small gift especially touched us. It was from the "little people" of an elementary school who made a collective donation in memory of one of their teachers. With charity beginning so early in life, the future must be bright.

David G. Cogan, M.D.
Director

For General Expenses

Individual benefactors

Anonymous
Mr. and Mrs. David P. Argentina
Dr. Hanford L. Auten
Dr. William P. Beetham
Mr. John B. Cecill, Jr.
Mr. Carey J. Chamberlin
Dr. Julian F. Chisholm, Jr.
Dr. Thomas G. Cogswell
Dr. Fred A. Dickerman
Dr. William F. Donoghue
Dr. Edwin B. Dunphy
Mr. Irvin E. Erb
Mrs. Carlton P. Fuller
Dr. Levon K. Garron
Dr. Herbert Giller
Mrs. Harold Haine
Mr. George B. Henderson
Mr. Max Hess
Dr. Kevin Hill
Dr. Carl C. Johnson
Mr. Howard M. Jones
Dr. Dewey Katz
Miss Elizabeth Keeley
Mr. Robert D. Kestnbaum
Dr. Henry A. Mosher
Dr. Roscoe W. Myers
Miss Irene F. Neuman
Mr. Walter G. O'Neil
Mrs. Simon Pearl
Dr. Frank A. Perreten
Dr. Abraham Pollen
Mr. Hamilton S. Putnam
Dr. Marian C. Putnam
Dr. Robert D. Reinecke
Mr. Carl N. Schmalz
Dr. Alfred W. Scott
Mr. Paul M. Steiner
Dr. Garrett L. Sullivan
Dr. Herbert A. Tuck
Dr. Francis J. West

Chandler Fund

Dr. Paul A. Chandler

Ulmer Fund

Mr. J. M. Ulmer

Memorial Funds

Emma J. Blackett
Co-workers of Warren H. Blackett

Christy Cogan
Dr. Charles W. Dyson
Mr. and Mrs. F. Osborne Elliott
Dr. Levon K. Garron
Dr. B. Thomas Hutchinson

Marion Doucette
Miss Shirley M. Pecue (representative of an employee group)

Leon A. Drury
Cities Service Oil Company
Mr. George W. Crockford, Jr.
Jennie E. Davis
Freda Drepanos
Mrs. Helen M. Drury
Mr. and Mrs. Bowers A. Fischer
Mr. and Mrs. Harold D. Harley
Irene Hauger
Mr. and Mrs. Raymond Howard
Mr. Robert M. Jenney
Ken Jones, Inc.
Mr. and Mrs. William H. Kinerey, Jr.
Mrs. Leonard Levalley
Mr. and Mrs. Arthur W. Lindblad
Mrs. Jane Pendleton
Miss Margaret M. Peterson
Sylvia F. Sherwin
Mr. and Mrs. Ernest G. Spaulding
Alice McD. Suri
Mr. E. J. Townsend
Mr. John A. Viola
Mr. Paul R. Welch, Jr.

Annetta Hicks
Mr. and Mrs. Matthew F. Tuley

Myra D. Hubbard
Miss Doris Hubbard

Maude A. MacNaught
Mr. and Mrs. Harold W. Carpenter
Mr. and Mrs. Thomas M. Peterson

Donald March
Mr. and Mrs. William Hocking, Jr.

Russell F. Mosman
Mr. and Mrs. Clarence R. Barrington

Samuel J. Pesiri
Mr. Frank E. Hannigan, Jr.

Minnie Rand
Miss Esther M. Claff

John E. Rines
Mrs. John E. Rines

Paul Salvaggio
Mrs. Eleanor Salvaggio

William Shube
Marblehead Lions Club

Esther M. Walent
Mr. and Mrs. William Hocking, Jr.

Genradco Trust

Massachusetts Lions Eye Research Fund, Inc.

Research to Prevent Blindness, Inc.

Shamroth Family Charitable Trust in honor of Louis Witten

Max, Martha and Alfred M. Stern Fund

For Specific Projects

American Contract Bridge League Charity Foundation Corp.
Glaucoma Research
Support of the Vision Information Center

Dr. Virgil G. Casten
Glaucoma Research

Dr. David G. Cogan
Neuro-ophthalmology Service

Marion Laboratories, Inc.
Studies on retinal blood flow

Alfred P. Sloan Foundation
Basic experimental studies in glaucoma

U. S. Atomic Energy Commission
The carbohydrate metabolism of ocular tissue

U. S. Public Health Service
General Research Support Grant
Center Grant
Ophthalmology Training Grant
Vision Information Center
Pressure regulating mechanisms in glaucoma
Research Career Development Award
Cataracts
Electron microscopy of retinal dehydrogenases
Differentiation of chick retina
Studies of iris ultrastructure

PUBLICATIONS

COGAN, D. G.

Corneal Edema: Introduction. Int. Ophthal. Clin. *8*:523–526, Fall 1968.

Pseudoretinitis pigmentosa. Report of two traumatic cases of recent origin. Arch. Ophthal. *81*:45–53, January 1969.

Frederick Herman Verhoeff. In memoriam. Ophthalmic Heritage series. Arch. Ophthal. *81*:300–302, February 1969.

with Souders, T. B.: Some clinical lessons from histopathology. Trans. Penn. Acad. Ophthal. 22:5–22, Spring 1969.

Editorial: So the blind may "see". New Eng. J. Med. *281*:215–216, July 24, 1969.

with Reese, A.B.: A syndrome of iris nodules, ectopic Descemet's membrane, and unilateral glaucoma. Docum. Ophthal. 26:424–433, 1969.

Foreword to: *Fundamentals of Ophthalmology. A Programmed Text.* By R. D. Reinecke and R. J. Herm. New York. Appleton-Century-Crofts. 1969.

The William Mackenzie Memorial Lecture. Retinal and Papillary Vasculitis: In: *The William Mackenzie Centenary Symposium on the Ocular Circulation in Health and Disease. Proceedings of a Symposium Held at the Royal College of Physicians and Surgeons of Glasgow, 23rd–24th September 1968.* Edited by J. S. Cant. St. Louis. Mosby. 1969. pp. 249–270.

DONALDSON, D. D.

with KING, Cdr. L., Guzak, S. V., Jr. and Lancaster R.: Feature Photo: Cirsoid aneurysm. Arch. Ophthal. *82*:138–139, July 1969.

with FEINGOLD, M. Shiere, F. and Helmi, R.: Rieger's syndrome. Pediatrics 44:564–569, October 1969.

Binocular direct ophthalmoscope. Arch. Ophthal. 82:781–783, December 1969.

GRANT, W. M.

Ocular complications of drugs. Glaucoma. JAMA 207:2089–2091, March 17, 1969.

Action of drugs on movement of ocular fluids. Ann. Rev. Pharmacol. *9*:85–94, 1969.

with Dahl, A.A.: Unusual keratitis from a household remedy. Am. J. Ophthal. *68*:858–862, November 1969.

HAINING, W. M.

with AMOILS, S. P.: Evolution of the cryogenic chorioretinal lesion. Arch. Ophthal. *81*:11–21, January 1969.

JEDZINIAK, J. A.

with Kinoshita, J. H.: Lens aldose reductase. Exp. Eye Res. *8*:232, April 1969.

Kinoshita, J. H.
with Merola, L. O. and Tung, B.: Osmotic effects of dulcitol retention in galactose cataract. *Biochemistry of the Eye. XXth International Congress of Ophthalmology. Munich 1966. Symposium at Tutzing Castle August 10–13, 1966.* Edited by M.U. Dardenne and J. Nordmann. Basel. Karger. 1968. pp. 373–382.
with Thoft, R. A. and Merola, L. O.: The rate of potassium exchange of galactosemic rat lenses. Chapter in: *Biochemistry of the Eye. XXth International Congress of Ophthalmology. Munich 1966. Symposium at Tutzing Castle August 10–13, 1966.* Edited by M.U. Dardenne and J. Nordmann. Basel. Karger. 1968. pp. 383–387.
with Chylack, L. T.: A biochemical evaluation of a cataract induced in a high-glucose medium. Invest. Ophthal. *8*:401–412, August 1969.
with Barber, W. G., Merola, L. O. and Tung, B.: Changes in the levels of free amino acids and myo-inositol in the galactose-exposed lens. Invest. Ophthal. *8*:625–632, December 1969.

Kuwabara, T.
with McTigue, J. W., Goldman, J. N. and Fine, B. S.: *Cornea, Anatomy and Pathology. Clinical Application of Electron Microscopy of the Cornea. A Course Presented at the American Academy of Ophthalmology and Otolaryngology October 29, 1968, Chicago, Illinois.* Boston. Howe Laboratory of Ophthalmology, Harvard Medical School. 1968.
with Goldman, J. N.: Histopathology of corneal edema. Int. Ophthal. Clin. *8*:561–579, Fall 1968.
with Kinoshita, J. H. and Cogan, D. G.: Electron microscopic study of galactose-induced cataract. Invest. Ophthal. *8*:133–149, April 1969.
with Lessell, S.: Experimental d-chymotrypsin glaucoma. Arch. Ophthal. *81*:853–864, June 1969.
with Lessell, S. and Feldman, R. G.: Myopathy and succinylcholine sensitivity. Am. J. Ophthal. *68*:789–796, November 1969.
Blood vessels in the normal retina. *The Retina: Morphology, Function and Clinical Characteristics.* Edited by B. R. Straatsma, M. O. Hall, R. A. Allen and F. Crescitelli. UCLA Forum in Medical Sciences No. 8, University of California Press, Berkeley and Los Angeles. 1969. pp. 163–176.
Scanning electron microscopic study of the cell surface. *27th Annual Proceedings EMSA.* Baton Rouge. Claitor's Publishing Division, 1969. pp. 36–37.
with Chazan, R. I., Balodimos, M. C. and Beetham, W. P.: The reactivity and ultrastructure of conjunctival microaneurysms in diabetes. Diabetologia 5:331–338, 1969.
with Aiello, L. M.: Effect of the ruby laser on the monkey retina: An electron microscopic study (Addendum to paper by Aiello et al). Chapter 54 in: *Symposium on the Treatment of Diabetic Retinopathy.* Public Health Service Publ. No. 1890. Edited

by M. F. Goldberg and S. L. Fine. Arlington, Va. U.S. Dept. of Health, Education and Welfare. 1969. pp. 665–671.

Reif-Lehrer, L.

with Chader, G. J.: The steroid induction of glutamine synthetase in chick embryo retinas in culture. A possible role of corticosteroid-binding globulin. Biochim. Biophys. Acta *192*:310–317, November 18, 1969.

Reinecke, R. D.

with Carroll, J. M.: Silicone lacrimal tube implantation. Trans. Am. Acad. Ophthal. Otol. *73*:85–90, January-February 1969.

Conjugate gaze viewer. Am. J. Ophthal. *67*:268–269, February 1969.

with Montgomery, W. W.: Frontal-lacrimal fistula. Am. J. Ophthal. *67*:591–592, April 1969.

with Eichhorn, M. M.: Development and implementation of a thesaurus for the visual sciences. J. Chem. Docum. *9*:114–118, May 1969.

with Brubaker, R. F. and Copeland, J. C.: Meridional refractometry. I. Derivation of equations. Arch. Ophthal. *81*:849–852, June 1969.

with Kuwabara, T.: Temporal arteritis. I. Smooth muscle cell involvement. Arch. Ophthal. *82*:446–453, October 1969.

with Herm, R. J.: *Fundamentals of Ophthalmology. A Programmed Text.* New York. Appleton-Century-Crofts. 1969. 205 pp.

Snyder, C.

Our Ophthalmic Heritage: *Archives of Ophthalmology*—A 100 year survey. Arch. Ophthal. *81*:605–611, May 1969.

Weidman, T. A.

with Kuwabara, T.: Development of the rat retina. Invest. Ophthal. *8*:60–69, February 1969.

Zweifach, P. H.

with Walton, D. S. and Brown, R. H.: Isolated congenital horizontal gaze paralysis. Occurrence of the near reflex and ocular retraction on attempted lateral gaze. Arch. Ophthal. *81*:345–350, March 1969.

LECTURES

ANDERSON, D. R.

Pathogenesis of glaucomatous cupping and field loss. New England Ophthalmological Society, February 12, 1969.

Optic nerve anatomy and physiology. Neuro-ophthalmic Pathology Meeting, Wilmer Institute, in Baltimore, Maryland, March 22, 1969.

With Spencer, W. H.: Ultrastructural and histochemical observations of optic nerve gliomas. Association for Research in Ophthalmology, in Sarasota, Florida, April 21, 1969.

Tonometry and tonography. Alumni Association of the Massachusetts Eye and Ear Infirmary, April 28, 1969.

Optic nerve gliomas. Neuro-ophthalmology Journal Club, in Boston, June 6, 1969.

with Grant, W. M.: Revaluation of the Schiotz tonometer calibration. Association for Research in Ophthalmology, in Chicago, Illinois, October 11, 1969

Scanning electron microscopy of zonules and trabecular meshwork. Association for Research in Ophthalmology, in Chicago, Illinois, October 12, 1969

CHADER, G. J.

with Orr, J. C.: Steroid biochemistry laboratory series. First Year Class, Harvard Medical School, September – December 1969.

Conference on steroid chemistry and cholesterol biosynthesis. First Year Class, Harvard Medical School, November 25, 1969.

COGAN, D. G.

Neuro-ophthalmology Symposium, University of Miami, in Miami, Florida, January 6–11, 1969:

1. Retinal and papillary vasculitis.
2. Instructive cases: Internuclear ophthalmoplegia.

Ocular muscles. House Officer Lecture, Massachusetts Eye and Ear Infirmary, January 30, 1969.

Clinical Pathology. Fourth Year Elective Course, Harvard Medical School, February 4–28, 1969.

Pseudotumor and dysthyroid exophthalmos. Thyroid Group, Massachusetts General Hospital, March 4, 1969.

Ophthalmic Research. Massachusetts Lions Clubs, Massachusetts Eye and Ear Infirmary, March 12 and December 5, 1969.

Visiting Professor, Wilmer Institute, Johns Hopkins Medical Institutions, in Baltimore, Maryland, March 17–21, 1969:

1. Diabetes
2. Fluoroangiography

Frederick Herman Verhoeff – Personal Recollections. American Ophthalmological Society, in Hot Springs, Virginia, May 26, 1969.

Congenital ocular defects. Second Conference on the Clinical Delineation of Birth Defects. Johns Hopkins Medical Institutions, in Baltimore, Maryland, May 26–29, 1969.

Clinicoanatomic correlations. Third Year Class, Harvard Medical School, September 19, 1969.

Neuro-ophthalmology. Postgraduate Course in Ophthalmology, Harvard Medical School, September 26, 1969.

The eye as a research tissue. Research Seminar, University of Connecticut School of Medicine and Dental Medicine, in Hartford, Connecticut, October 7, 1969.

Ocular signs of systemic disease. Massachusetts Society for the Prevention of Blindness and Postgraduate Medical Institute, in Boston, October 8, 1969.

Frederick Herman Verhoeff — Memorial Minutes. Faculty Meetting, Harvard Medical School, November 7, 1969.

Diabetes and the eye. Science Writers Seminar, Research to Prevent Blindness, in Beverly Hills, California. November 8–11, 1969.

Tribute to Frederick H. Verhoeff. New England Ophthalmological Society, November 19, 1969.

Pathology and pathogenesis of diabetic retinopathy. Diabetes Association of Greater Chicago, in Chicago, Illinois, November 21, 1969.

DONALDSON, D. D.

Eye Symposium of the San Antonio Ophthalmology and Otolaryngology Society, in San Antonio, Texas, January 26, 1969:
Iris atrophy types and treatment
Diagnosis of conjunctival lesions

Toxic, degenerative and neoplastic diseases of the conjunctiva. Ophthalmology residents of Wilmer Institute, Johns Hopkins Hospital, in Baltimore, Maryland, February 17, 1969.

Surgery of the orbit. American College of Surgeons, in Boston, March 11, 1969.

Tennessee Academy of Ophthalmology and Otolaryngology, in Gatlinburg, Tennessee, April 11, 1969:
Blowout fractures of the orbit
Conjunctival tumors

Postgraduate Course for Internists, Pediatricians and General Practitioners, Harvard Medical School, May 10, 1969:
Systemic diseases
Retinal manifestations of systemic diseases

Orbital floor fractures. Oral Surgeons, Massachusetts General Hospital, June 6, 1969.

Corneal dystrophies, systemic diseases. Department of Continuing Education, Harvard Medical School, June 19, 1969.

Lancaster Courses in Ophthalmology, in Waterville, Maine, July 21–25, 1969:
Neuro-ophthalmology
Neuroanatomy.

Fourth Year Class, Harvard Medical School:
Systemic diseases and corneal dystrophies, January 14, 1969
Systemic diseases, August 2, 1969

External diseases, August 13–14, 1969
Anterior segment, August 14–15, 1969
Ocular changes in systemic diseases, November 15, 1969

Anterior segment. Basic Science Course in Ophthalmology, University of Pennsylvania, in Philadelphia, Pennsylvania, August 25, 1969.

Postgraduate Course in Ophthalmology, Harvard Medical School:
Neuroanatomy, September 4–30, 1969
Neuro-ophthalmology, October 1–7, 1969
Anterior segment and fundus, October 29 and December 18, 1969
Gross neuropathology, November 19, 1969
Anterior chamber and cataracts, December 18, 1969

Differential diagnosis of the "red eye". Massachusetts Society for the Prevention of Blindness and the Postgraduate Medical Institute, October 8, 1969

Cataracts and glaucoma. Trustees of the Massachusetts Lions Eye Research Fund, Inc., in Boston, December 5, 1969.

House Officer Lectures, Massachusetts Eye and Ear Infirmary:
Eye manifestations of systemic diseases, February 1, 1969
Conjunctival tumors, March 4, 1969
Corneal dystrophies, March 13, 1969
Endothelial and other dystrophies of the cornea, April 15, 1969
Maculopathies, May 13, 1969
Report on the 1969 Meeting of the American Ophthalmological Society, June 10, 1969

FRICKER, S. J.

Electrophysiological Measurements. Northeastern University, in Boston, June 2, 1969.

Measurement of eye motion and derived parameters. Harvard-Yale Seminar, in Boston, June 9, 1969.

Clinical electrophysiology. Fourth Year Elective Course, Harvard Medical School, July 20, 1969.

Electrophysiology. Postgraduate Course in Ophthalmology, Harvard Medical School, September 6 and 9, 1969.

The clinical significances of ERG time delay measurements. Seventh International Symposium on Electroretinography, in Istanbul, Turkey, September 14–18, 1969.

Electrical determination of macular function. New England Ophthalmological Society, November 19, 1969.

GRANT, W. M.

Fourth Year Class, Harvard Medical School:
Tonometry, tonography and introduction to ocular hydrodynamics, February 3, 1969
Physiology and pharmacology related to intraocular pressure, February 6, 1969

Ophthalmic toxicology, February 10, 1969.

House Officer Lectures, Massachusetts Eye and Ear Infirmary: Autonomic drugs and the eye, April 1, 1969
Questions on glaucoma, June 26, 1969

Glaucoma. Alumni Association of the Massachusetts Eye and Ear Infirmary, April 27, 1969.

Lectures to the Department of Pharmacology, Harvard Medical School, June 30, July 2 and 7, 1969.

Postgraduate Course in Ophthalmology, Harvard Medical School: Tonometry and tonography, September 22, 1969
Toxicology, September 29, 1969

Toxic effect on the eye of various systemic drugs and the effects of local steroids on vision. Massachusetts Society for the Prevention of Blindness and Postgraduate Medical Institute, in Boston, October 8, 1969.

JEDZINIAK, J. A.

Allosteric properties of lens aldose reductase. Association for Research in Ophthalmology, in Woods Hole, June 29, 1969.

KINOSHITA, J. H.

Galactosemic cataracts. Pediatric Seminar, Massachusetts General Hospital, March 21, 1969

with Chylack, L. T.: Biochemistry and cataracts. Alumni Association of the Massachusetts Eye and Ear Infirmary, April 27, 1969.

Lens aldose reductase. Department of Biological Chemistry Seminar, Harvard Medical School, May 12, 1969.

Lens glucose metabolism. Joslin Laboratory Seminar, in Boston, June 10, 1969.

Aldose reductase inhibitors. Ophthalmic Biochemistry Conference, in Woods Hole, June 29, 1969.

Series of lectures on the biochemistry of the cornea, lens and retina, Lancaster Courses in Ophthalmology, in Waterville, Maine, July 8–10, 1969.

Series of lectures on the biochemistry of the cornea, lens and retina. Postgraduate Course in Ophthalmology, Harvard Medical School, September 3–8, 1969.

Sugar cataracts. Alcon Laboratories, in Fort Worth, Texas, September 12, 1969.

Diabetic cataracts. Tokyo Ophthalmological Society, in Tokyo, Japan, September 26, 1969.

Lens glucose metabolism. Lens Symposium, in Nikko, Japan, September 30, 1969.

Sugar cataracts. National Science Writers Symposium, Research to Prevent Blindness, in Beverly Hills, California, November 11, 1969.

Diabetic cataracts. New England Diabetes Association, in Boston, November 15, 1969.

KUWABARA, T.

House Officer Lectures, Massachusetts Eye and Ear Infirmary: Crystaline materials in the ocular tissue, January 7, 1969.

Pathology of retinal vessels, January 14, 1969.

Scanning electron microscopy of the ocular tissue, July 22, 1969.

Scanning electron microscopic study of corneal wound healing. New England Ophthalmological Society, January 15, 1969

Structure of the eye. Series of lectures to the Fourth Year Class, Harvard Medical School, January 1969.

Corneal wound healing, a scanning electron microscopic study. Association for Research in Ophthalmology, in Baltimore, Maryland, March 7, 1969.

Light sensitivity of the developing retina. New England Ophthalmological Society, March 19, 1969.

Scanning electron microscopy of the ocular tissue. Alumni Association of the Massachusetts Eye and Ear Infirmary, April 27, 1969

with Simmons, R. J.: Diagnostic aids in epithelialization of the anterior chamber. Alumni Association of the Massachusetts Eye and Ear Infirmary, April 28, 1969.

with Wong, V. and Brubaker, R.: Intracellular alterations in cystinosis. New England Ophthalmological Society, April 29, 1969.

Retinal pathology. Visiting Professor, Department of Ophthalmology, University of California Los Angeles in Los Angeles, California, May 7, 1969.

Vascular change in diabetes. Visiting Professor, Department of Pathology, University of California Los Angeles, in Los Angeles, California, May 8, 1969.

Fine structure of the eye. Series of lectures, Boston University Medical School, May 13–15, 1969.

Morphology of retinal vascular disease. Symposium on Ocular Structure and Function, Queen's University, in Kingston, Ontario, Canada, May 31, 1969.

Scanning electron microscopic study of the corneal surface. Cornea Conference, in Boston, June 6, 1969.

Retina, anatomy and physiology. Northeastern University, in Boston, June 16, 1969.

Anatomy of the cornea. Course on the Cornea, Department of Continuing Education, Harvard Medical School, June 19, 1969.

Laser damage on the retina. Gordon Research Conference, in Meriden, New Hampshire, June 20, 1969.

Structure of the eye. Lancaster Courses in Ophthalmology, in Waterville, Maine, July 4–7, 1969.

with Brown, S. I.: A new type of mucopolysaccharoidosis of the cornea. Section on Ophthalmology, American Medical Association, in New York City, July 14, 1969.

Cell surfaces of the parenchymatous organ. Electron Microscopy Society of America, in St. Paul, Minnesota, August 26, 1969.

Pathology in diabetes. National Institutes of Health Symposium on Diabetes, in Hyannisport, September 3, 1969.

Postgraduate Course in Ophthalmology, Harvard Medical School: Series of lectures: Structure of the eye. September-October, 1969. Nutritional support of the retina. October 17, 1969.

Surface structure of the ocular tissue. Eye Symposium, Kyushu University, in Fukuoka, Japan, September 24, 1969.

Recent advances in ophthalmic anatomy and pathology. Ophthalmological Society of Tokyo, in Tokyo, Japan, October 3, 1969.

Scanning electron microscopy of the ocular tissue. American Academy of Ophthalmology and Otolaryngology and Association for Research in Ophthalmology, in Chicago, Illinois, October 12, 1969.

Ophthalmic pathology. Department of Pathology, Massachusetts General Hospital, December 9, 1969.

with Lemp, M., Holly, F., Iwata, S., Carroll, J. M. and Dohlman, C. H.: Conjunctival mucus — the natural wetting agent. New England Ophthalmological Society, December 17, 1969.

Reinecke, R. D.

Programmed instruction. Harvard Public Health Lecture, in Cambridge, April 8, 1969.

Self instruction in medical education. National Society for Programmed Instruction, in Washington, D. C., April 10, 1969.

AC:A ratio and its relationship to exodeviations. Philadelphia County Medical Society, in Philadelphia, Pennsylvania, April 11, 1969.

Trend in postgraduate education — Information Center. College of Physicians and Surgeons, in Philadelphia, Pennsylvania, April 17, 1969.

Tests for ocular motility. Alumni Association of the Massachusetts Eye and Ear Infirmary, April 28, 1969.

Current treatment of amblyopia. New England Ophthalmological Society, April 29, 1969.

Refraction. Visiting Professor, University of California Los Angeles, in Los Angeles, California, April 1969.

Comitant strabismus refractive errors. Third Year Class, Harvard Medical School, May 3, 1969.

The eye and orbital resiliency in thyroid disease. Section on Ophthalmology, Massachusetts Medical Society, May 29, 1969.

Refraction. Visiting Professor, Wilmer Institute, Johns Hopkins Medical Institutions, in Baltimore, Maryland, July 17–19, 1969.

Vision Information Center, its uses and goals. American Academy of Optometry, in Philadelphia, Pennsylvania, December 14, 1969.

Vertical muscles and resident questions. House Officer Lecture, Massachusetts Eye and Ear Infirmary, October 29, 1969.

Snyder, C.

Backgrounds of ophthalmology. Boston University School of Medicine, Section of Ophthalmology, March 5 and 12, 1969.

The history of the Massachusetts Eye and Ear Infirmary. Postgraduate Course in Ophthalmology, Harvard Medical School, October 23, 1969.

The origin of ophthalmic terms. Postgraduate Course in Ophthalmology, Harvard Medical School, October 24, 1969.

WORTHEN, D. M.

Pathogenesis of hereditary ocular disease. New England Ophthalmological Society, March 19, 1969.

Ocular dermal pathology. Eye Residents, University of Texas, in Dallas, Texas, April 25, 1969.

Ocular anatomy and physiology; strabismus and neuro-ophthalmology. Postgraduate Course for Internists and General Practitioners, Harvard Medical School, May 9–10, 1969.

Ocular physiology. Series of lectures to the Students in Orthoptics, Simmons College, in Boston, academic year 1969.

Ocular anatomy and physiology. Postgraduate Nursing Course, Massachusetts Eye and Ear Infirmary, three groups in 1969.

Physical diagnosis: Examination of the eye. Second Year Class, Harvard Medical School, February 26, 27, November 14 and 19, 1969.

Third Year Class, Harvard Medical School:
Introduction to the Clinics:
Peter Bent Brigham Hospital students, July 30, 1969.
Visual field, pupil and nystagmus, September 10, 1969.

Uveitis, retinal detachment and cataract. Fourth Year Elective Course, Harvard Medical School, January 1969.

Cryotechniques in ophthalmology. House Officer Lecture, Massachusetts Eye and Ear Infirmary, September 3, 1969.

Postgraduate Course in Ophthalmology, Harvard Medical School:
Tangent Screen, October 22, 1969.
Anatomy, October 30, November 6, 13, 20, 1969.
Pathology, November 12, December 1, 3, 4, 8, 9, 10, 11, 15, 1969.

WRAY, S. H.

The microcirculation in occlusive vascular disease of the retina. McMillan Hospital, in St. Louis, Missouri, February 20, 1969.

New ideas and concepts in categories of nervous diseases. Course in Neurology for Internists. Harvard Medical School, Massachusetts General Hospital, March 12, 1969.

First Canadian Course in Neuro-ophthalmology. Toronto General Hospital, in Toronto, Ontario, Canada, April 15–17, 1969.

with Rogell, G. D.: The effect of papaverine on the retinal circulation in the monkey. A fluorescein angiographic study. Alumni Association of the Massachusetts Eye and Ear Infirmary, April 28, 1969.

Ophthalmology for internists and pediatricians. Harvard Medical School, May 9, 1969.

Neuroanatomy and neuro-ophthalmology. Postgraduate Course in Ophthalmology, Harvard Medical School, September-October 1969.

The visual system. Neuro-anatomy Course, Harvard Medical School, October 15, 1969.

New England Ophthalmological Society, November 19, 1969:
Neuro-ophthalmology: Presentation of cases.

with Pavan-Langston, D.: An evaluation of tensilon tonography in the diagnosis of myasthenia gravis.

Atypical features of temporal arteritis — a review. Mt. Auburn Hospital, in Cambridge, November 20, 1969.

with Pavan-Langston, D.: An evaluation of tensilon tonography in the diagnosis of myasthenia gravis. Annual Scientific Session of the National Medical Advisory Board of the Myasthenia Gravis Foundation, in New York City, December 5, 1969.

WURSTER, J. B.

Diabetic retinopathy. 373rd General Hospital, Boston Army Base, January 22, 1969.

Fluorescein angiography of ocular fundus. Retina Fellows, Massachusetts Eye and Ear Infirmary, February 26, 1969.

Maculopathies. House Officer Lecture, Massachusetts Eye and Ear Infirmary, May 13, 1969.

Anatomy of the visual system. Lancaster Courses in Ophthalmology, in Waterville, Maine, June 13, 1969.

EXHIBITS

Kuwabara, T.
Surface Structure of the Ocular Tissue. Association for Research in Ophthalmology, in Sarasota, Florida, April 19–23, 1969.

Wray, S. H., Guzak, S. V., Cogan, D. G. and Lancaster, R. D. Fluorescein Angiography of the Fundus Oculi. Section on Ophthalmology, American Medical Association, July 13–17, 1969.

FORM OF BEQUEST

The Howe Laboratory of Ophthalmology is an independent department of the Harvard Medical School and is jointly supported by a restricted endowment of Harvard University and by the Massachusetts Eye and Ear Infirmary.

For the information of those who may wish to contribute to this Laboratory, a form of bequest is here set forth:

I Give and Bequeath to the Howe Laboratory of Ophthalmology ..... Dollars

To be Applied to the Uses of Said Laboratory.

Such bequests are managed by the Treasurer's Office of Harvard University and are tax deductible. The income is accredited to the Laboratory.

Collaborators

Wadi I. Bardawil, John M. Carroll, Paul A. Chandler, Leo T. Chylack, Jr., David N. Cohen, William J. Collis, Andrew A. Dahl, Alexander R. Gaudio, Robert A. Gorn, David L. Guyton, Steven V. Guzak, Mark Hallett, Brent W. Lambert, George W. Lazenby, Joseph Michon, Jr., Don H. Nicholson, Deborah Pavan-Langston, Jose D. Peczon, David C. Poskanzer, John W. Reed, Gerald D. Rogell, Richard J. Simmons, James H. Swarr, David S. Walton.

Secretarial and Technical Personnel

Roberta F. Beer, Robert L. Berghold, Inez M. Berry, Mary F. Bradford, David Braun, Dennise A. Busby, Susan A. Caswell, Cynthia R. Curtin, Frederick M. Dittmar, Dorothy A. Drago, Kristina J. Eriksen, Edward M. Gadowski, Kerstin Gestrin, Carole A. Hardy, Barbara L. Harper, Edith James, Robert C. Kasabian, Dixie W. Kaslick, Sheldon P. Kottle, Brigita Kreismanis, Richard Lewis, Alfred Ley, Agnes Love, Audrey C. Melanson, Gloria Merola, William M. Mills, Werner Mueller, Jr., Thomas A. Musliner, E. Joann Perkins, Sam Prescott, Laura W. Rice, Thomas M. Richardson, Elaine Roochvarg, Edith A. Salling, Marjorie E. Saunders, Brain Schrauf, Malcolm W. Swan, Charles Tara, Linda A. Theberge, Bill H. C. Tung, May W. Vuilleumier, Olga Wehm-Dalton, Ellen M. Yates.